REMARKS

Claims 1-2 and 4-11, and 13-22 are pending in this application. By this Amendment, claims 1, 13, 14 and 17 are amended, claim 12 is canceled without prejudice to or disclaimer of the subject matter contained therein, and claims 18-22 are added. No new matter is added. Reconsideration is respectfully requested in view of the above amendments and the following remarks.

The Office Action rejects claims 1-2, 4-7, 11 and 15-16 under 35 U.S.C. §103(a) over Kawai (U.S. Patent No. 6,239,033) in view of David Lide (CRC Handbook of Chemistry and Physics, 82nd Edition) and O'Brien (U.S. Patent No. 5,059,763). This rejection is respectfully traversed.

Embodiments of the invention are directed to formation of a semiconductor device with a body of low thermal conductivity that achieves improved thermal resistance and may have increased structural rigidity. In the past, reduction of thermal resistance of low thermal conductivity materials such as sapphire was achieved by thinning the semiconductor substrate (paragraph **[0006]**). However, further thinning can result in inferior structural integrity. The thermal resistance if not sufficiently thinned can cause a heat rise or build up due to power absorption that may damage the device.

This problem of excessively high thermal conductivity has been remedied by the method of claim 1, wherein a cavity having a length or width substantially equal to or greater than the semiconductor structure is provided that is substantially filled with a material having a higher conductivity than the body of the semiconductor substrate. See, for example, Applicants' Figs. 8-9 and paragraph **[0052]** where the partially filled cavity 216 is of substantial size relative to the semiconductor structure (p-contacts 240). Moreover, because the reduction in thermal resistance can be achieved without further thinning, or by

substantially filling the cavity with the material of greater thermal conductivity, structural rigidity can be maintained or enhanced.

Kawai appears to suffer from the same problem acknowledged in the background. Kawai uses a sapphire substrate and relies on backside polishing to thin the material. However, as discussed above, there is a limit on how thin the substrate can be polished without weakening the substrate. Thus, it appears that Kawai may rely on this "thinning" to compensate for low thermal conductivity of sapphire. However, the via hole 8, 35 relied upon by the Examiner as corresponding to the recited cavity is not for the same purpose as in the invention. Instead, the via hole is used to make electrical connection. Thus, its primary purpose is electrical conductivity and there is no teaching or suggestion of improving heat dissipation properties of the sapphire substrate while maintaining structural integrity of the substrate. Thus, there is no motivation to size the cavity to have a length or width substantially equal to or larger than the semiconductor structure, such as the p-contact, as recited in independent claim 1.

Lide is only relied upon for identification of the thermal conductivity of Au and thus fails to overcome the deficiencies of Kawai with respect to independent claim 1. O'Brien also fails to overcome the deficiencies of Kawai with respect to claim 1. O'Brien merely shows formation of a groove by laser ablation, but is not concerned with problems of high thermal resistance. Thus, even if combined, the combination fails to teach or suggest the recited features of independent claim 1.

Accordingly, independent claim 1 and claims dependent therefrom define over Kawai (in combination with the Lide Handbook) and O'Brien.

New independent claim 22 (as well as original dependent claim 13) specifies that the cavity is formed to a depth that is less than the thickness of the body so that the cavity opens

onto the bottom surface without opening onto the top surface, the substantially filled cavity forming a heat path that transports heat from the semiconductor structure away from the substrate.

Kawai, as discussed above, uses via 8, 35 solely for electrical connection. Accordingly, Kawai's structure cannot perform its intended purpose unless the via extends completely through the substrate to make contact with element 24. Accordingly, Kawai specifically teaches away from the method steps of claim 22. Moreover, because there is no appreciation of the problem being solved by the method of claim 22, and because modification of the Kawai structure to meet the claim language would destroy the intended operation of the Kawai device, there can be no teaching or suggestion of such a modification.

O'Brien fails to overcome the deficiencies of Kawai with respect to independent claim 22. O'Brien merely is relied upon for laser ablation and does not appreciate the problems overcome by the invention recited in claim 22.

Accordingly, independent claim 22 defines over Kawai (in combination with the Lide Handbook) and O'Brien. Withdrawal of the rejection is respectfully requested.

The Office Action rejects claims 8-9 over Kawai in view of O'Brien and David Lide, and further in view of Mistry et al. (U.S. Patent No. 5,731,046). This rejection is respectfully traversed.

Kawai, Lide, and O'Brien are discussed above. Mistry fails to overcome the deficiencies of these references with respect to independent claim 1. Accordingly, dependent claims 8-9 are allowable for their dependence on an allowable base claim and for the additional features recited therein. Withdrawal of the rejection is respectfully requested.

The Office Action rejects claim 10 under 35 U.S.C. §103(a) over Kawai in view of O'Brien and David Lide, and further in view of Maeda et al. (U.S. Patent No. 6,189,771). This rejection is respectfully traversed.

Kawai, Lide, and O'Brien are discussed above. Maeda fails to overcome the deficiencies of these references with respect to independent claim 1. Accordingly, dependent claim 10 is allowable for their dependence on an allowable base claim and for the additional features recited therein. Withdrawal of the rejection is respectfully requested.

The Office Action rejects claims 12-14 and 17 under 35 U.S.C. §103(a) over Kawai in view of O'Brien and David Lide, and further in view of Dunnrowicz et al. (U.S. Patent No. 6,163,557). This rejection is respectfully traversed.

Kawai, Lide, and O'Brien are discussed above. Dunnrowicz fails to overcome the deficiencies of these references with respect to independent claim 1. Accordingly, dependent claims 12-14 and 17 are allowable for their dependence on an allowable base claim and for the additional features recited therein.

Moreover, with respect to dependent claim 13, the Office Action fails to make a prima facie case of obviousness and it is believed that this claim is misunderstood. This claim specifies that the cavity is formed to a depth that is less than the thickness of the body so that the cavity opens only onto the bottom. See, for example, see Applicants' Figs. 4, 7, or 13 where the cavity is of a lesser depth than the body of the device and only opens to the bottom (i.e., it does not open to the top). Claim 13 is amended to clarify this feature.

The Office Action relies on Dunnrowicz for a teaching to reduce the thickness of the sapphire substrate. However, the sapphire substrate is a body of high thermal resistance. This body is already taught to be thinned in Kawai (Col. 4, lines 3-26). Furthermore, because Kawai relies on contact with the upper element 24 for electrical connectivity, modification to

the via hole 35 in Kawai would defeat its intended purpose. Accordingly, the alleged combination is improper and dependent claim 13 defines over the alleged combination.

With request to dependent claim 14, this claim recites a step structure to the cavity. A step structure is not taught in the applied references.

Withdrawal of the rejection is respectfully requested.

In view of the foregoing, it is respectfully submitted that this application is in condition for allowance. Favorable reconsideration and prompt allowance of claims 1-2, 4-11, and 13-22 are earnestly solicited.

Should the Examiner believe that anything further would be desirable in order to place this application in even better condition for allowance, the Examiner is invited to contact the undersigned at the telephone number set forth below.

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